Values of Critical Indexes for Inhomogeneous Equilibrium Liquids under Gravity

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The nonmonotonic temperature dependences of scattered light intensity I(h, t) ~ $(d\rho/d\mu)_T$ (h, t), compressibility $(d\rho/d\mu)_T$(h,t) under constant fields h = $\rho_c g\Delta z/P_c$, equilibration time τ_e(t) in an inhomogeneous system under gravity have been revealed [1, 2] for the first time during investigating of gravity effect near the critical point. On the basis of temperature dependence I(h, t) at h = const [1] close to the critical temperature (t = 0) and equilibration time $\tau_e \sim t^{\beta\delta-\nu}$ [2] behaviour in inhomogeneous system the following inequalities between critical indexes have been obtained [3, 4]:

$$3\mu\xi - 2 / (\beta\delta) < 0; \quad \beta\delta - \nu - 1 < 0. \qquad (1)$$

Using the inequalities (1) and the relations between critical indexes of fluctuation theory of phase transitions [5] the following inequalities for critical indexes [3, 4] have been obtained:

$$\nu < 2/3; \ \xi > 2/5; \ \delta < 5; \ \gamma < 4/3; \ \beta > 1/3; \ \eta > 0; \ \alpha > 0. \qquad (2)$$

Then on the basis of (1)-(2) and [5] the equations for calculating the values of the critical indexes of the correlation length ν, ξ ($R_c \sim t^{-\nu}$} and $R_c \sim \Delta\mu^{-\xi}$}) can be proposed:

$$\nu^2 \quad 0.096\, \nu - 0.464 = 0; \qquad (3)$$
$$\xi^2 - 0.937\, \xi \quad 0.215 = 0. \qquad (4)$$

From (3) and (4) the values of critical indexes [5] have been found:

$$\xi = 0.405 \pm 0.003, \ \xi = 0.636 \pm 0.005, \ \beta = 0.338 \pm 0.002,$$
$$\gamma = 1.23 \pm 0.01, \ \alpha = 0.09 \pm 0.01, \ \eta = 0.06 \pm 0.005, \ \delta a = 4.64 \pm 0.05. \qquad (5)$$

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